Semi-Annual Report to the Pennsylvania Public Utility Commission

Phase III of Act 129

Program Year 9

(June 1, 2017 – May 31, 2018)

For Pennsylvania Act 129 of 2008

Energy Efficiency and Conservation Plan

Prepared by Cadmus

For

PPL Electric Utilities

January 15, 2018

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Acronyms

BDR	Behavioral Demand Response
C&I	Commercial and Industrial
CFL	Compact Fluorescent Lamp
CSP	Conservation Service Provider or Curtailment Service Provider
DLC	Direct Load Control
DR	Demand Response
EDC	Electric Distribution Company
EDT	Eastern Daylight Time
EE&C	Energy Efficiency and Conservation
EM&V	Evaluation, Measurement, and Verification
EUL	Effective Useful Life
GNE	Government, Non-Profit, Education
HVAC	Heating, Ventilating, and Air Conditioning
ICSP	Implementation Conservation Service Provider
kW	Kilowatt
kWh	Kilowatt-hour
LED	Light-Emitting Diode
LIURP	Low-Income Usage Reduction Program
M&V	Measurement and Verification
MW	Megawatt
MWh	Megawatt-hour
NTG	Net-to-Gross
P3TD	Phase III to Date
PA PUC	Pennsylvania Public Utility Commission
PSA	Phase III to Date Preliminary Savings Achieved; equal to VTD + PYTD
PSA+CO	PSA savings plus Carryover from Phase II
PY	Program Year: e.g. PY8, from June 1, 2016, to May 31, 2017
PYRTD	Program Year Reported to Date
PYVTD	Program Year Verified to Date
RTD	Phase III to Date Reported Gross Savings
SWE	Statewide Evaluator
TRC	Total Resource Cost
TRM	Technical Reference Manual
VTD	Phase III to Date Verified Gross Savings

Types of Savings

Gross Savings: The change in energy consumption and/or peak demand that results directly from program-related actions taken by participants in an EE&C program, regardless of why they participated.

Net Savings: The total change in energy consumption and/or peak demand that is attributable to an EE&C program. Depending on the program delivery model and evaluation methodology, the net savings estimates may differ from the gross savings estimate due to adjustments for the effects of free riders, changes in codes and standards, market effects, participant and nonparticipant spillover, and other causes of changes in energy consumption or demand not directly attributable to the EE&C program.

Reported Gross: Also referred to as *ex ante* (Latin for "beforehand") savings. The energy and peak demand savings values calculated by the EDC or its program Implementation Conservation Service Providers (ICSP), and stored in the program tracking system.

Verified Gross: Also referred to as *ex post* (Latin for "from something done afterward") gross savings. The energy and peak demand savings estimates reported by the independent evaluation contractor after the gross impact evaluation and associated M&V efforts have been completed.

Verified Net: Also referred to as *ex post* net savings. The energy and peak demand savings estimates reported by the independent evaluation contractor after application of the results of the net impact evaluation. Typically calculated by multiplying the verified gross savings by a net-to-gross (NTG) ratio.

Annual Savings: Energy and demand savings expressed on an annual basis, or the amount of energy and/or peak demand an EE&C measure or program can be expected to save over the course of a typical year. Annualized savings are noted as MWh/year or MW/year. The Pennsylvania TRM provides algorithms and assumptions to calculate annual savings, and Act 129 compliance targets for consumption reduction are based on the sum of the annual savings estimates of installed measures.

Lifetime Savings: Energy and demand savings expressed in terms of the total expected savings over the useful life of the measure. Typically calculated by multiplying the annual savings of a measure by its effective useful life. The TRC Test uses savings from the full lifetime of a measure to calculate the cost-effectiveness of EE&C programs.

Program Year Reported to Date (PYRTD): The reported gross energy and peak demand savings achieved by an EE&C program or portfolio within the current program year. PYTD values for energy efficiency will always be reported gross savings in a semi-annual or preliminary annual report.

Program Year Verified to Date (PYVTD): The verified gross energy and peak demand savings achieved by an EE&C program or portfolio within the current program year.

Phase III to Date (P3TD): The energy and peak demand savings achieved by an EE&C program or portfolio within Phase III of Act 129. Reported in several permutations described below.

> **Phase III to Date Reported (RTD):** The sum of the reported gross savings recorded to date in Phase III of Act 129 for an EE&C program or portfolio.
>
> **Phase III to Date Verified (VTD):** The sum of the verified gross savings recorded to date in Phase III of Act 129 for an EE&C program or portfolio, as determined by the impact evaluation finding of the independent evaluation contractor.

Phase III to Date Preliminary Savings Achieved (PSA): The sum of the verified gross savings (VTD) from previous program years in Phase III where the impact evaluation is complete plus the reported gross savings from the current program year (PYTD). For PY8, the PSA savings will always equal the PYTD savings because PY8 is the first program year of the phase (no savings will be verified until the PY8 final annual report).

Phase III to Date Preliminary Savings Achieved + Carryover (PSA+CO): The sum of the verified gross savings from previous program years in Phase III plus the reported gross savings from the current program year plus any verified gross carryover savings from Phase II of Act 129. This is the best estimate of an EDC's progress toward the Phase III compliance targets.

Table 1 lists savings values for a hypothetical EDC as of the PY10 semi-annual report, when the first six months of PY10 reported savings are available. The calculations below are then used to illustrate the differences between various savings values.

Table 1: P3TD Savings Calculation Example

Program Period	Reported Gross (MWh/year)	Verified Gross (MWh/year)
Phase II (Carryover)	N/A	400
PY8	800	700
PY9	900	850
PY10 (Q1+Q2)	500	N/A

PYRTD (PY10) = 500 MWh/year

RTD = 800 + 900 + 500 = 2,200 MWh/year

VTD = 700 + 850 = 1,550 MWh / year

PSA = 1,550 + 500 = 2,050 MWh/year

PSA + CO = 2,050 + 400 = 2,450 MWh/year

1 Introduction

Pennsylvania Act 129 of 2008, signed on October 15, 2008, mandated energy savings and demand reduction goals for the largest electric distribution companies (EDCs) in Pennsylvania for Phase I (2008 through 2013). Phase II of Act 129 began in 2013 and concluded in 2016. In late 2015, each EDC filed a new energy efficiency and conservation (EE&C) plan with the PA PUC detailing the proposed design of its portfolio for Phase III. These plans were updated based on stakeholder input and subsequently approved by the PUC in 2016.

Implementation of Phase III of the Act 129 programs began on June 1, 2016. This report documents the progress and effectiveness of the Phase III EE&C accomplishments for PPL Electric Utilities in Program Year 9 (PY9), as well as the cumulative accomplishments of the Phase III programs since inception. This report additionally documents the energy savings carried over from Phase II. The Phase II carryover savings count towards EDC savings compliance targets for Phase III.

This report details the participation, spending, and reported gross impacts of the energy efficiency programs in PY9. Compliance with Act 129 savings goals are ultimately based on verified gross savings. PPL Electric Utilities has retained Cadmus as an independent evaluation contractor for Phase III of Act 129. Cadmus is responsible for the measurement and verification of the savings and calculation of verified gross savings. The verified gross savings for PY9 energy efficiency programs will be reported in the final annual report, to be filed on November 15, 2018.

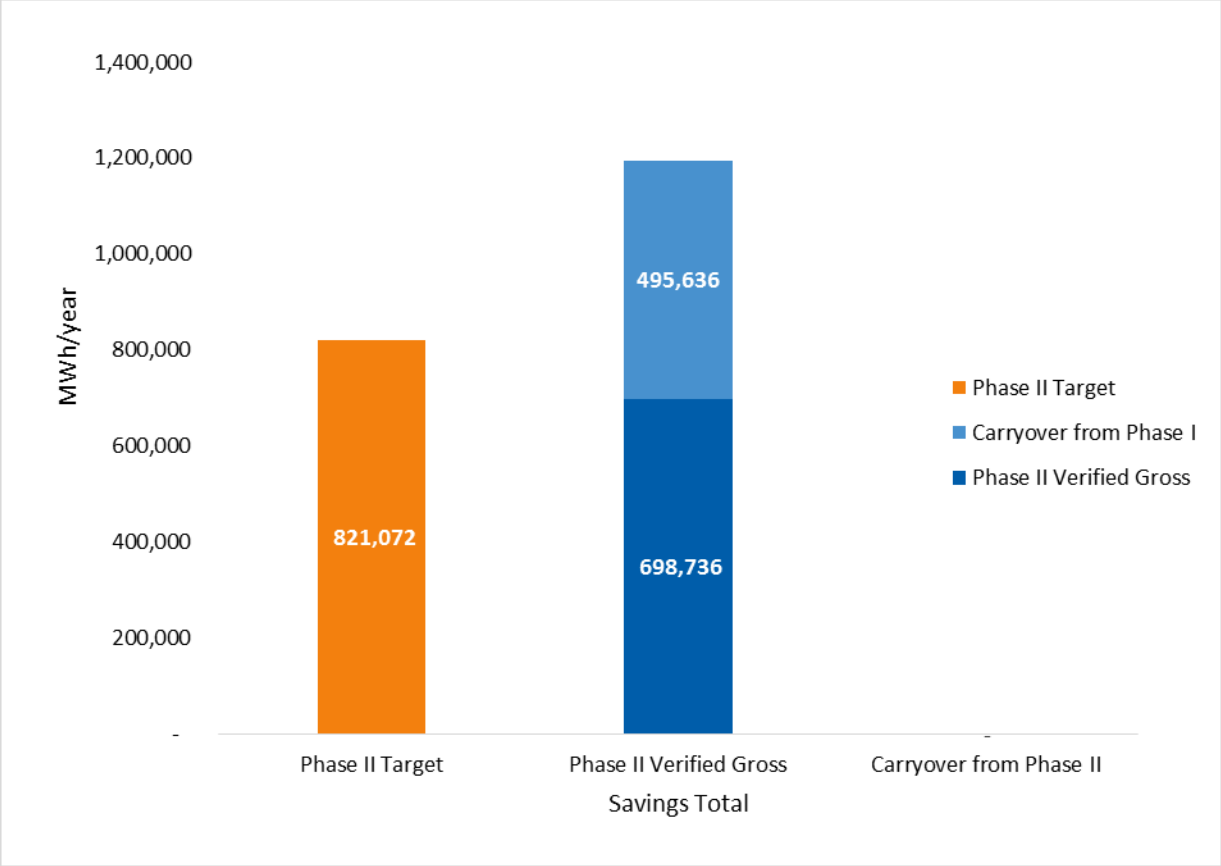
Phase III of Act 129 includes a demand response goal for PPL Electric Utilities. Demand response events are limited to the months of June through September, which are the first four months of the Act 129 program year. Because the demand response season is completed early in the program year, it is possible to complete the independent evaluation of verified gross savings for demand response sooner than is possible for energy efficiency programs. Section 6.2 of this report includes the verified gross demand response impacts for PY9 as well as the cumulative demand response performance of this EE&C program to date for Phase III of Act 129.

2 Summary of Achievements

2.1 Carryover Savings from Phase II of Act 129

PPL Electric Utilities does not have carryover savings from Phase II. Figure 1 compares PPL Electric Utilities' Phase II verified gross savings total to the Phase II compliance target to illustrate the carryover calculation.

Figure 1: Carryover Savings from Phase II of Act 129



The Commission's Phase III Implementation Order[1] also allowed EDCs to carry over savings in excess of the overall (portfolio) Phase II savings compliance target, in excess of the Phase II GNE savings compliance target and in excess of the Phase II low-income savings compliance target.[2] PPL Electric Utilities did not have carry over savings for the portfolio but did exceed its Phase II compliance targets for GNE and low-income. However, in the August 3, 2017,

[1] Pennsylvania Public Utility Commission, *Energy Efficiency and Conservation Program* Implementation Order, at Docket No. M-2014-2424864, (*Phase III Implementation Order*), entered June 11, 2015.
[2] Proportionate to those savings achieved by dedicated low-income programs in Phase III.

Compliance Order,[3] the PA PUC determined that because PPL Electric Utilities did not obtain Phase II savings in excess of its Phase II consumption reduction requirement, PPL Electric Utilities was not entitled to any GNE or low-income sector carryover savings into Phase III.

2.2 PHASE III ENERGY EFFICIENCY ACHIEVEMENTS TO DATE

Since the beginning of Program Year 9 on June 1, 2017, PPL Electric Utilities has claimed:

- 167,420 MWh/yr of reported gross electric energy savings (PYRTD)
- 23.43 MW/yr of reported gross peak demand savings (PYRTD) from energy efficient programs
- 115.64 MW/yr of reported gross peak demand savings (PYRTD) from demand response programs

Since the beginning of Phase III of Act 129 on June 1, 2016, PPL Electric Utilities has achieved:

- 547,449 MWh/yr of reported gross electric energy savings (RTD)
- 124.24 MW/yr of reported gross peak demand savings (RTD) from energy efficiency programs
- 115.64 MW/yr of reported gross peak demand savings (RTD) from demand response programs
- 498,764 MWh/yr of gross electric energy savings (PSA). This total includes verified gross savings from previous Phase III program years[4] and the PYTD reported gross savings from PY9.
    - 27,432 MWh/yr from PY8 remain unverified, thus are not included in PSA.
- 70.24 MW/yr of gross peak demand savings (PSA) from energy efficiency programs
- 126.68 MW/yr of verified gross peak demand savings (PSA) from demand response programs

PPL Electric Utilities has achieved:

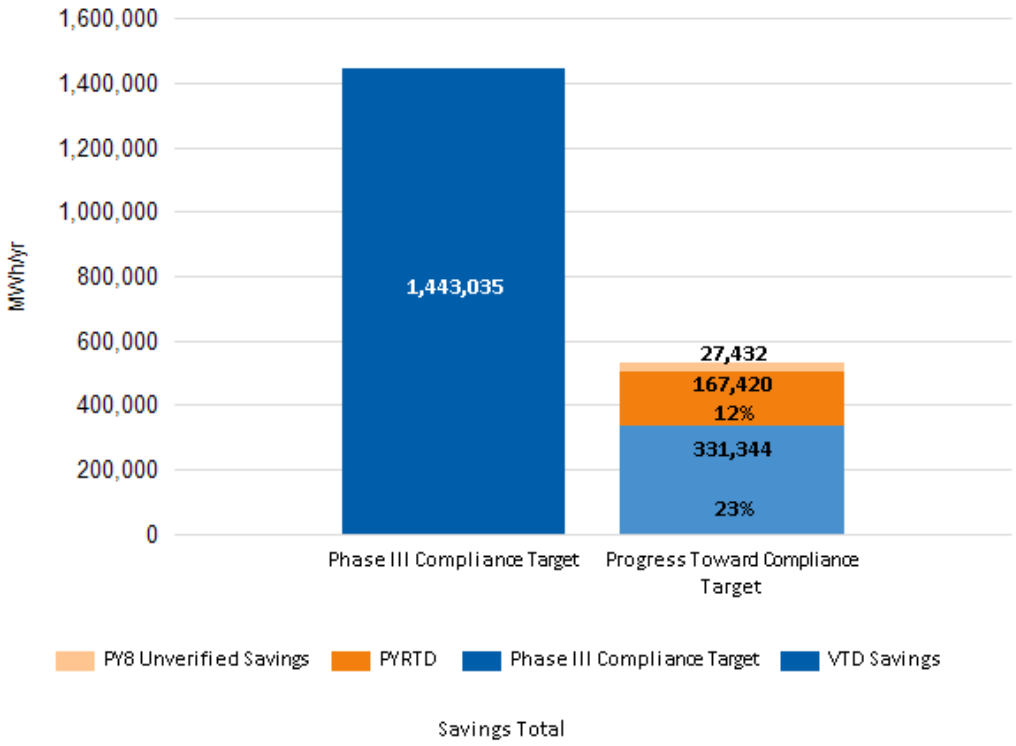
- 498,764 MWh/yr of PSA+CO energy savings recorded to date in Phase III[5]
    - This represents 35 percent of the May 31, 2021, energy savings compliance target of 1,443,035 MWh/yr.

[3] The Order addresses the EDCs' compliance with the Phase II energy reduction targets and the Petitions for reconsideration of the April 6, 2017, Compliance Order filed by Duquesne, PECO, and PPL Electric Utilities. Pennsylvania Public Utility Commission. Act 129 Phase II Final Compliance Order. Docket No. M-2012-2289411. Adopted August 3, 2017. Available online: http://www.puc.pa.gov/filing_resources/issues_laws_regulations/act_129_information/energy_efficiency_and_conservation_ee_c_program.aspx

[4] Verified savings from previous program years have been adjusted to account for Home Energy Education Program energy savings uplift (see Appendix C in the PY8 Annual Report). Uplift results in savings counted in more than one program; therefore, an adjustment is made to prevent double counting. Unverified savings from PY8 are not included in PSA.

[5] Verified savings from previous program years have been adjusted to account for Home Energy Education Program energy savings uplift (see Appendix C in the PY8 Annual Report). Uplift results in savings counted in more than one program; therefore, an adjustment is made to prevent double counting. Unverified savings from PY8 are not included in PSA.

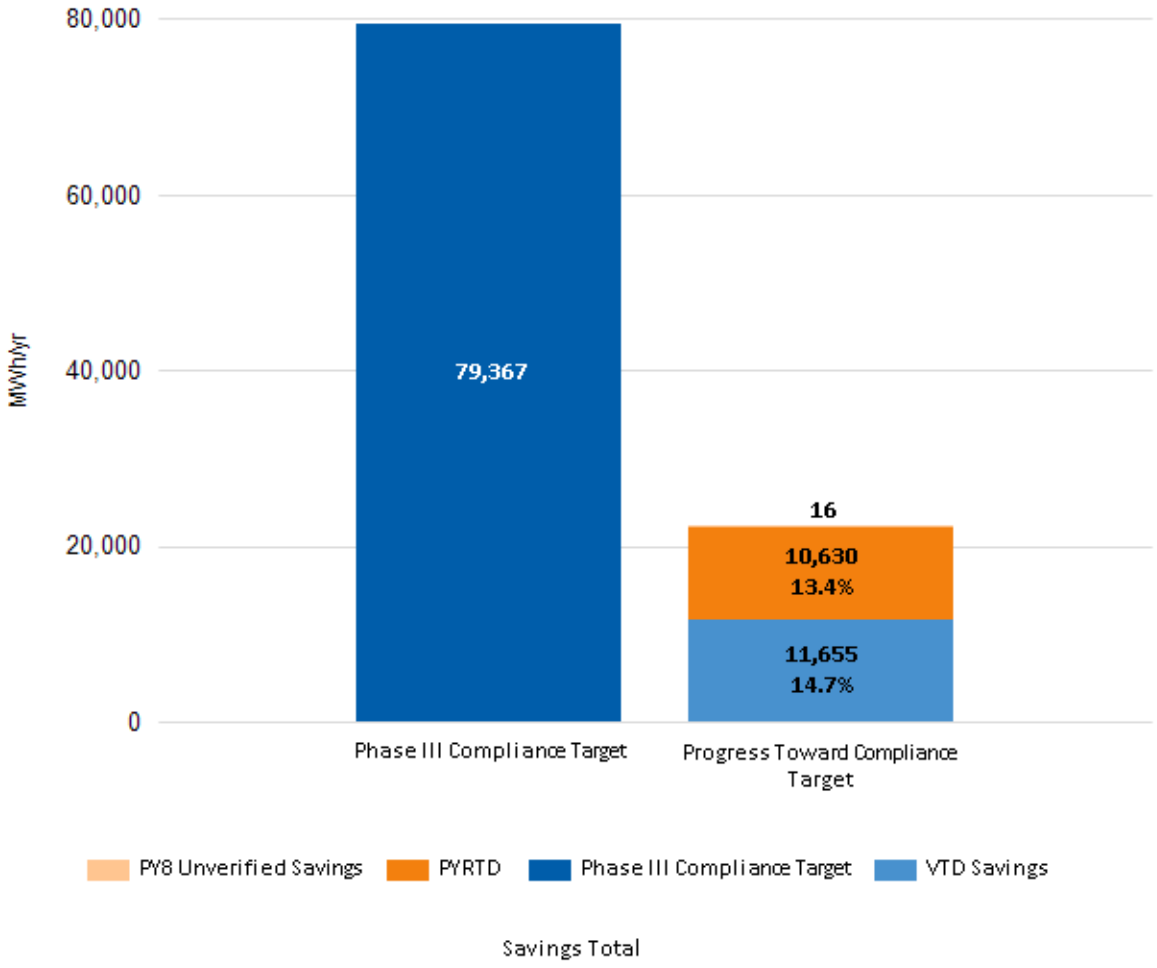
Figure 2: EE&C Plan Performance Toward Phase III Portfolio Compliance Target



The Phase III Implementation Order directed EDCs to offer conservation measures to the low-income customer segment based on the proportion of electric sales attributable to low-income households. The proportionate number of measures target for PPL Electric Utilities is 9.95%. PPL Electric Utilities offers a total of 95 EE&C measures to its residential and non-residential customer classes. There are 21 measures available to the low-income customer segment at no cost to the customer. This represents 22% of the total measures offered in the EE&C plan and exceeds the proportionate number of measures target.

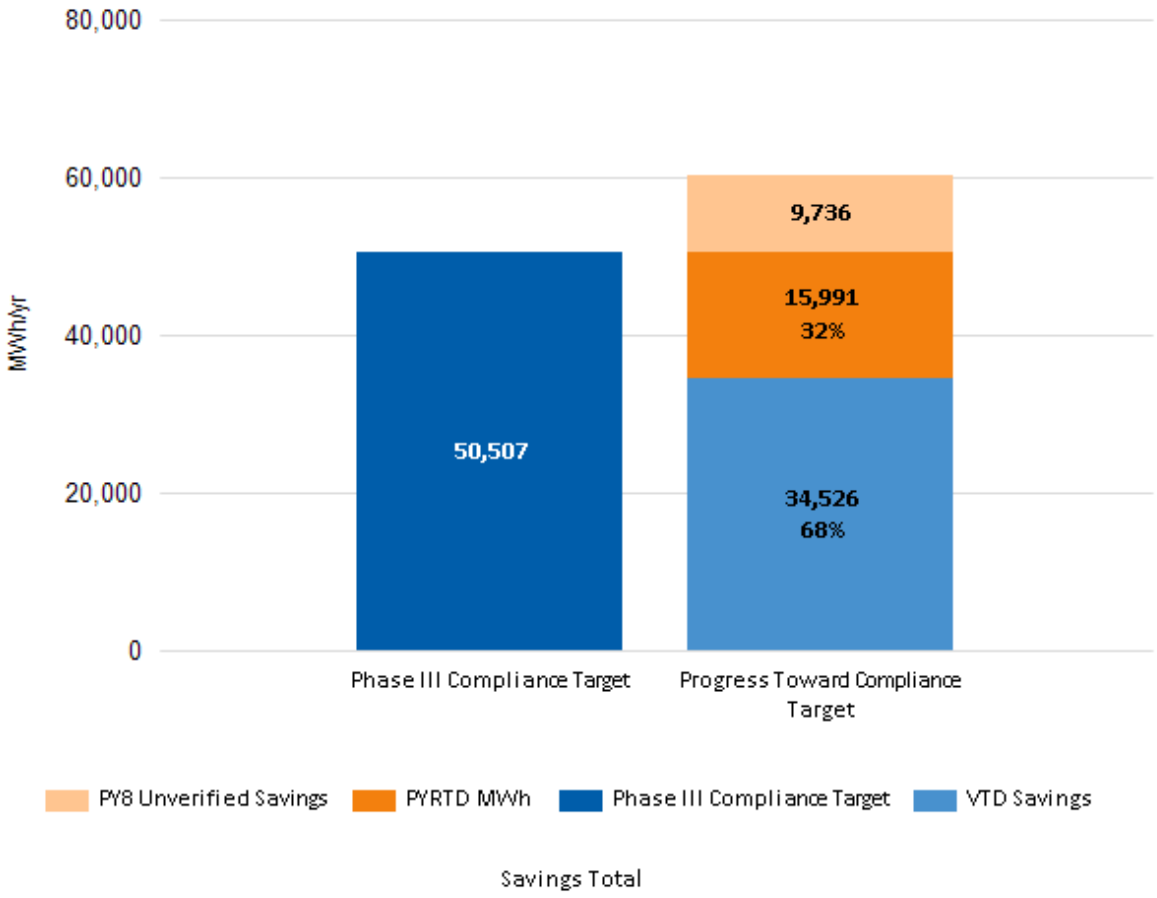
The PA PUC also established a low-income energy savings target of 5.5% of the portfolio savings goal. The low-income savings target for PPL Electric Utilities is 79,367 MWh/yr and is based on verified gross savings. Figure 3 compares the PSA+CO performance to date for the low-income customer segment to the Phase III savings target. Based on the latest available information, PPL Electric Utilities has achieved 28% of the Phase III low-income energy savings target.

Figure 3: EE&C Plan Performance Toward Phase III Low-Income Compliance Target



The Phase III Implementation Order established a government, non-profit, and educational energy savings target of 3.5% of the portfolio savings goal. The GNE savings target for PPL Electric Utilities is 50,507 MWh/yr and is based on verified gross savings. Figure 4 compares the PSA+CO performance to date for the GNE customer segment to the Phase III savings target. Based on the latest available information, PPL Electric Utilities has achieved 100% of the Phase III GNE energy savings target.

Figure 4: EE&C Plan Performance Against Phase III GNE Compliance Target



2.3 PHASE III DEMAND RESPONSE ACHIEVEMENTS TO DATE

The Phase III demand response performance target for PPL Electric Utilities is 92 MW per event hour. Compliance targets for demand response programs are based on average performance across events and were established at the system level, which means the load reductions measured at the customer meter must be escalated to reflect transmission and distribution losses.

Act 129 demand response events are triggered by PJM's day-ahead load forecast. When the day-ahead forecast is above 96% of the peak load forecast for the year, a demand response event is initiated for the following day. In PY9, there were three demand response events called. Table 2 lists the days that DR events were called along with the verified gross demand reductions achieved by each program. Table 2 also lists the average DR performance for PY9 and for Phase III to date. PPL Electric Utilities' average DR performance to date is above the Phase III compliance reduction target by 38%.

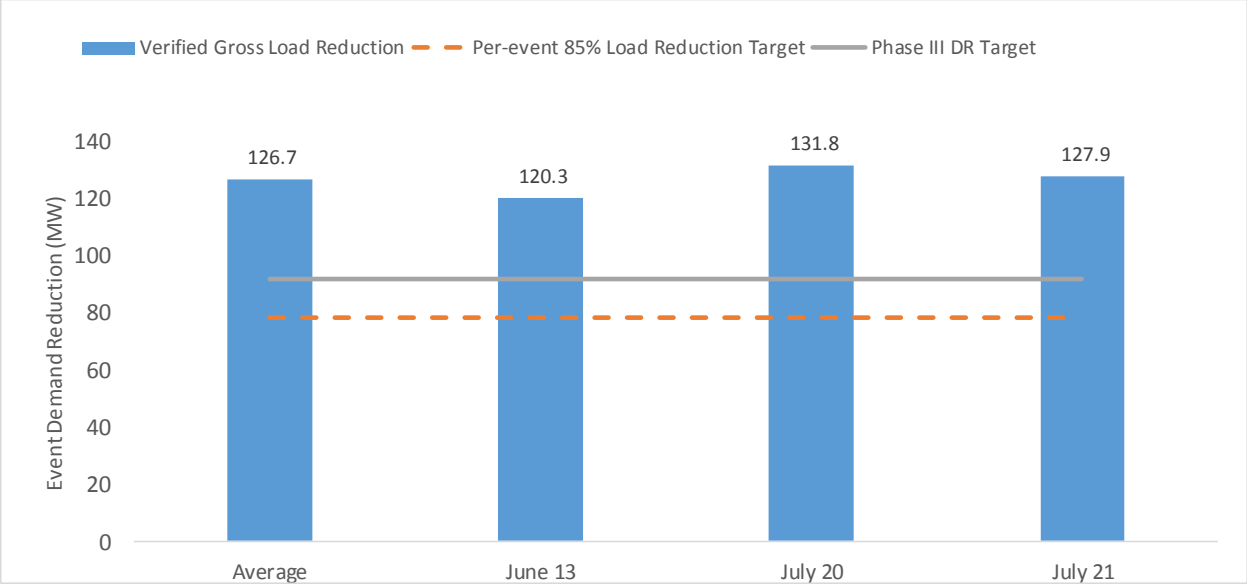
Table 2: PY9 Demand Response PYVTD Performance by Event

Event Date	Start Hour	End Hour	Small CI Load Curtailment	Large CI Load Curtailment	GNE Load Curtailment	Portfolio MW/event Impact[1]
June 13	14	17	3.0	113.9	3.5	120.3
July 20	14	17	0.2	127.0	4.7	131.8
July 21	14	17	-	123.0	4.9	127.9
PYVTD - Average PY9 DR Event Performance						126.7
VTD - Average Phase III DR Event Performance						126.7

[1] Portfolio MW/event may not equal sum of customer segment MW/event because of rounding error.

The Commission's Phase III Implementation Order also established a requirement that EDCs achieve at least 85% of the Phase III compliance reduction target in each DR event. For PPL Electric Utilities, this translates to a 78.2 MW minimum for each DR event. Figure 5 compares the performance of each of the DR events in PY9 to the event-specific minimum and average targets.

Figure 5: Event Performance Compared to 85% Per-Event Target



Note: The load impacts reported in this figure are based on Cadmus analysis of participant AMI consumption data and have been grossed up to reflect transmission and distribution losses.

2.4 PHASE III PERFORMANCE BY CUSTOMER SEGMENT

Table 3 presents the participation, savings, and spending by customer sector for PY9. The residential, small C&I, large C&I sectors are defined by EDC tariff and the residential low-income and governmental/educational/non-profit sector were defined by statute (66 Pa. C.S. § 2806.1). The residential low-income segment is a subset of the residential customer class and the GNE segment will include customers who are part of the small C&I or large C&I rate classes. The savings, spending, and participation values for the LI and GNE segments have been removed from the parent sectors in Table 3.

Table 3: PY9 Summary Statistics by Customer Segment

Parameter	Residential [1]	Low-Income	Small C&I [1]	Large C&I	GNE	Total [2]
Number of Participants	156,279	9,770	9,159	259	715	176,182
PYRTD MWh/yr	65,514	10,630	47,255	28,030	15,991	167,420
PYRTD MW/yr (Energy Efficiency)	8.40	0.93	8.23	3.76	2.10	23.43
PYVTD MW/yr (Demand Response) [3]	-	-	1.05	121.29	4.34	126.68
Incentives ($1000)	$4,892	$0	$1,049	$2,447	$1,125	$9,514

[1] 17,817 of reported MWh/yr from Efficient Lighting are attributed to Small C&I.
[2] Total may not sum due to rounding.
[3] Savings are presented as the average of the total demand response savings per event across the June 13, July 20, and July 21 Act 129 events.

Table 4 summarizes plan performance by sector since the beginning of Phase III.

Table 4: Phase III Summary Statistics by Customer Segment

Parameter	Residential [1]	Low Income	Small C&I [1]	Large C&I	GNE	Total [2]
Number of Participants	705,919	24,366	28,004	441	1,263	759,993
PSA MWh/yr [3]	239,108	22,284	116,125	75,125	50,517	503,159
PSA MW/yr (Energy Efficiency)	32.06	2.09	19.97	9.48	6.64	70.24
Phase III MW/yr (Demand Response) [4]	-	-	1.05	121.29	4.34	126.68
Incentives ($1000)	$17,073	$0	$5,209	$6,002	$3,688	$31,972

[1] 50,588 of PSA MWh/yr and from Efficient Lighting are attributed to Small C&I.
[2] Total may not sum due to rounding.
[3] The residential verified savings included in PSA MWh/yr have not been adjusted to account for energy savings uplift (double counting) in the Home Energy Education Program
[4] Savings are presented as the average of the total demand response savings per event across the June 13, July 20, and July 21 Act 129 events.

3 Updates and Findings

3.1 Implementation Updates and Findings

The Pennsylvania Utility Commission approved PPL Electric Utilities' revised EE&C plan on October 26, 2017. This plan combined budgets and savings for the nonresidential custom and efficient equipment programs into a single program.

- **Appliance Recycling:** Customers continue to provide PPL Electric with positive feedback for this program. There were over 7,000 participants in PY9 and over 18,000 participants phase to date who recycled refrigerators, freezers, and room air conditioners. Dehumidifiers were added to the program for PY9. A small appliance recycling event was well received by customers; it provided a convenient drop-off location for room air conditioners and dehumidifiers without the necessity of including a large appliance.
- **Custom:** There continues to be a significant number of CHP projects, especially from the GNE customer sector. Due to the high demand by the GNE sector, a waitlist will begin on 1/15/2018.
- **CEI:** The program launched successfully. There are four new school districts participating with a total of 17 schools and four school districts who had participated in the program in Phase II, with a total of 27 schools in Phase III.
- **Demand Response:** PPL Electric Utilities' ICSP enrolled 93 customers' facilities in the program either through their prime ICSP, CPower, or sub-contractors during PY8 (June 1, 2016, to May 31, 2017). Due to PJM forecasts, PPL Electric Utilities initiated three events during the summer of PY9. The average performance of the three events was 126 MWs, exceeding the program performance requirement of 92 MW per event and a minimum of 78.2 MWs per event.
- **Efficient Equipment Distributor Discount:** The number of distributors continues to grow from 14 in PY8 to 25 in PY9. The number of projects completed through this channel in PY9 are approximately double that of PY8. PPL Electric Utilities' ICSP continues to improve QA/QC for projects and education to distributors to improve program performance. A SPIFF was offered to drive participation and awareness of the program. Additional eligible items are in the process of being added to the catalog for the program.
- **Efficient Equipment Prescriptive Equipment:** Additional enhancements have been added to the customer facing website and online rebate portal to enhance the tracking of projects as they move through the rebate verification process. Regular webinars for contractors and customers have been held to increase awareness of the eligible measures.
- **Efficient Equipment Prescriptive Lighting:** Direct Discount continues to be a key driver for this program. While Direct Discount is available for several measures, lighting is the primary measure installed through this program. Customers continue to participate in the prescriptive lighting program for larger projects.
- **Efficient Lighting:** PPL Electric has seen strong LED bulb sales over the first year of the program with sales exceeding 3,500,000 bulbs. This is the highest level of sales in a single year, even with increasing competition from non-program bulbs (inexpensive, non-Energy Star LEDs). Over 5,000,000 bulbs were sold phase-to-date. PPL Electric intentionally slowed down lighting significantly to avoid exhausting the budget too early. There was a diverse mix of bulbs sold – General Service 70%, Reflector 17%, Specialty 11%, and Indoor Fixtures 2%. A connected lighting pilot will be launched in early 2018. The kit will

consist of one central hub (Wink 2) and five pre-configured bulbs, including three A19 general service bulbs and two BR30 reflector bulbs used for recessed lighting.

- **Energy-Efficiency Kits and Education:** The Energy Efficiency Kits and Education program launched June 1, 2016, and targets income eligible customers. The program is on target with over 17,000 kits delivered through direct mail or one of the 20 participating agencies. The program enjoys an extremely high customer satisfaction level at 99%.
- **Energy Efficient Home:** Phase-to-date, over 24,000 customers have completed the online assessment and over 8,000 received an energy efficiency kit for their home. The online rebate application portal has been well received by customers and a new mobile responsive portal was launched in November. Ductless heat pumps are the most popular HVAC measure with more than 800 projects in PY9. A baseboard electric smart thermostat pilot was launched in March 2017 with a goal of 20 thermostats installed before winter – to date 10 applications were received. There is significant interest in efficient new home construction with 346 homes in PY9; there were a total of 518 in all of Phase 2. Measures included PV, duct sealing, air sealing, high-efficiency HVAC systems, Energy Star appliances, high-performance windows, and insulation.
- **Home Energy Education:** This program sends Home Energy Reports to customers; it is not a rebate program. Program savings were 15% less than expected in PY8, but customers continue to provide positive feedback about the improvements made to the Home Energy Reports in Phase III. Customers like the new look and feel, comparisons are more accurate, recommendations are personalized, and there has been a much lower opt out rate. Electronic versions of the Home Energy Reports were implemented to augment the paper report.
- **Low-Income WRAP:** The program for income eligible customers launched June 1, 2016 with a seamless transition for customers from Phase II to Phase III. Customer interest and satisfaction remains high. The program has completed approximately 7,000 jobs, including participants in the Manufactured Home initiative. Interest in WRAP for multifamily buildings has generated over 4,000 completed or pending jobs with a queue of over 6,000 individual low-income tenants (combination of individual and master-metered).
- **Student Energy Efficient Education:** The program was fully subscribed for PY9 and reached over 24,000 children at approximately 200 schools, including over 24,000 kits distributed to participating children. Two pilots will run in PY9, one for high school students that includes a Tier II power strip and one for middle school students that introduces an app aimed at increasing installation rates.

3.2 Evaluation Updates and Findings

This section summarizes evaluation activities occurring within each program during PY9. For each program offered in PY9, Cadmus updated the evaluation plans, and submitted them to PPL Electric Utilities and the SWE.

- **Appliance Recycling:** Cadmus received participant data from PPL Electric Utilities' tracking database for Q1 and Q2 and confirmed that it contains the necessary data for evaluation activities. Cadmus is preparing the PY9Q2 data request for SWE. Cadmus launched customer satisfaction surveys in November 2017.

- **Custom:** Cadmus verified savings for five PY9 large sample projects and two PY8 projects that were originally presented as "unverified" in the PY8 Annual Report (savings that were claimed in PY8 for projects that were installed and operating in PY8, but for which M&V activities were not completed in PY8.) Ongoing evaluation activities, including review of project documentation, creation of site-specific measurement and verification plans, deployment of evaluator installed metering equipment, determination of project savings using a high-rigor approach, and presenting finalized savings in a verification report, are currently underway for three small sample projects and approximately 40 large stratum projects. Cadmus launched online quarterly customer satisfaction surveys in November 2017.
- **CEI:** Cadmus drafted the stakeholder interview guide and expects to conduct the interviews in late January or early February 2018. Cadmus received participant data from CLEAResult and requested participants' AMI billing data from PPL. We expect to receive the billing data in January and will build the baseline models to estimate energy consumption in absence of the program during the program year, to estimate savings.
- **Demand Response:** Cadmus met with PPL Electric Utilities and the program implementer to discuss program design and changes. Cadmus reviewed the program materials and received participant data, and completed the target number (10) of participant interviews. Cadmus estimated load impacts for each of 93 participant facilities during event hours of the June 13, July 21, and July 22 Act 129 events. Cadmus completed the PY9 annual report and delivered the annual report and data request on January 15, 2018.
- **Efficient Equipment Distributor Discount:** Cadmus received the PY9Q1 database for the Distributer Discount program and confirmed that it contains the necessary information for evaluation activities. Cadmus selected an evaluation sample and requested project data from the implementer. Cadmus received and reviewed the PY9Q1 sample project data and scheduled site visits, and is conducting verification site visits for a sample of 20 lighting projects. Cadmus received the PY9Q2 database and is preparing the PY9Q2 data request.
- **Efficient Equipment Prescriptive Equipment (Standard Path):** Cadmus received the PY9Q1 database for the Prescriptive Equipment program and confirmed that it contains the necessary information for evaluation activities. Due to the small number of Q1 projects, Cadmus will combine Q1 and Q2 projects to select the first PY9 evaluation project sample. Cadmus received the PY9Q2 database and is preparing the combined PY9Q1-Q2 data request. Online quarterly customer satisfaction surveys launched in November 2017.
- **Efficient Equipment Prescriptive Lighting (Standard Path and Direct Discount):** Cadmus received the PY9Q1 database for the Prescriptive Lighting program component and confirmed that it contains the necessary information for evaluation activities. Cadmus selected a Standard Path and Direct Discount evaluation sample and requested project data from the implementer. Cadmus received and reviewed the PY9Q1 sample project data, scheduled and conducted over 20 verification site visits. Cadmus received the PY9Q2 database and is preparing the PY9Q2 data request. Online quarterly customer satisfaction surveys launched in November 2017.
- **Efficient Lighting:** Cadmus received Q1 and Q2 data from PPL Electric Utilities' tracking database, and copies of invoices and tracking data from the ICSP for Q1. Cadmus provided data to the SWE to fulfill the PY9Q1 data request and is preparing the PY9Q2 data request.

- **Energy-Efficiency Kits and Education:** Cadmus received Q1 enrollment and survey data from the ICSP, and expects to receive Q2 enrollment and survey data in early January 2018. Cadmus reviewed the PY9Q1 and Q2 tracking data from PPL Electric Utilities' tracking database, and will conduct a records review with Q1 and Q2 data provided by the subcontracting ICSP.
- **Energy Efficient Home:** Cadmus developed the equipment, online assessment, in-home audit, and weatherization participant survey instruments and began fielding the surveys in November 2017. Cadmus received the PY9Q1 data for all program components and confirmed that it contains the necessary data for evaluation activities. Cadmus selected samples for Efficient Equipment, and New Homes components, and requested data from the implementer, and is preparing the PY9Q2 data request for the SWE.
- **Home Energy Education:** Cadmus met with the ICSP and program subcontractor to discuss PY9 program implementation changes and data QC procedures. PPL Electric Utilities decided to reinstate the two Phase II low-income waves at the end of PY8, and plans to continue the low-income treatment sometime in PY9; currently the ICSP has not sent treatment to low-income customers in PY9. Cadmus revised the PY9 evaluation plan reflecting changes to the program implementation and included the low-income waves in the impact evaluation activities. As a benchmarking activity, PPL Electric requested a comparison of vendors that offer similar real-time (AMI) usage data and customer engagement products/programs.
- **Low-Income WRAP:** Cadmus met with the ICSP and PPL Electric Utilities to discuss PY9 evaluation plan changes and PY9 evaluation methodology. Cadmus received Q1 enrollment and survey data from the ICSP, and expects to receive Q2 enrollment and survey data in early January 2018. Cadmus reviewed the PY9 Q1 and Q2 data, and will conduct a thorough records review.
- **Student Energy Efficient Education:** The ICSP provides program data once per year, in PY9Q3.

4 Summary of Participation by Program

Participation is defined differently for each program depending on the program delivery channel and data tracking practices. The nuances of the participant definition vary by program and are summarized by program in Table 5. The table provides the current participation totals for PY9 and Phase III.

Table 5: EE&C Plan Participation by Program

Program	Participant Definition	PY9TD Participation	P3TD Participation
Appliance Recycling (ARP)	Unique job number; corresponds with each unique appliance decommissioned through the program during the program year	7,125	18,493
Demand Response	Unique job number; corresponds to a customer that participated in a demand response event	93	93
Nonresidential Energy Efficiency	Lighting and Equipment: Unique job number; corresponds to each unique job that received a rebate Custom: Unique job number; commercially operable job that received an incentive payment during the reporting period; only includes those projects that contribute to program savings; incentive adjustment jobs with zero savings, where the MeasureCode field has a value of "IncAdjust" are not included in the participant counts Distributor Discount: Unique job number; corresponds to each purchase of discounted products	2,346 [1]	4,168 [1]
Efficient Lighting	Person or business purchasing discounted bulbs. Because of the upstream design of the Efficient Lighting Program, the identities of purchasers are not known. The proportional breakdown of bulbs between the residential and small commercial sectors was estimated in PY8, as were bulbs-per-customer counts. These metrics were derived from residential and commercial customer data collected in a general population telephone survey. Participation is estimated by dividing the total number of bulbs discounted or given away by the bulbs-per-customer estimates.	147,171	483,392
Energy-Efficiency Kits and Education [2]	Unique job number; corresponds to an energy-savings kit delivered to an income-eligible customer through the agency or the direct-mail delivery channel	5,354	17,471
Energy Efficient Home (EE Home)	Unique job number; corresponds to a rebated project Households could have more than one rebated project	9,659	21,060
Home Energy Education (HEE)	Unique bill account number and household that receives a home energy report	0 [1]	184,257 [1]

Program	Participant Definition	PY9TD Participation	P3TD Participation
Low-Income Winter Relief Assistance Program (WRAP)	Unique bill account number; corresponds to an income-eligible household that receives an audit and program services. In PY8, a participant was defined as a unique job, but the updated definition is applied retroactively here. Therefore, the P3TD total will not match the PY8 total plus PY9TD.	4,434	6,914
Student Energy Efficient Education (SEEE)	Number of participants is counted as the number of kits delivered	0 [1]	24,145 [1]
Portfolio Total		**176,182**	**759,993**

[1] Participants in the Continuous Energy Improvement, Home Energy Education and Student Energy Efficient Education programs are not yet available and will be reported later in PY9
[2] Participation is determined by the unique job numbers. Returned kits are assigned two unique job numbers: one for the distributed kit, and one for the returned kit.

Because of the upstream design of the Efficient Lighting Program, the identities of purchasers are not known. The proportional breakdown of bulbs between the residential and small commercial sectors was estimated in PY8, as were bulbs-per-customer counts. These metrics were derived from residential and commercial customer data collected in a general population telephone survey. Participation is estimated by dividing the total number of bulbs discounted or given away by the bulbs-per-customer estimates.

Table 6: Efficient Lighting Participant Estimates

Year	Delivery Channel	Residential Quantity	Small C&I Quantity	Total Quantity	Bulbs per Small C&I Customer	Bulbs per Residential Customer	Estimated Small C&I Participants	Estimated Residential Participants	Total Estimated Participants
PY8	Retail Buy Down	3,174,906	352,767	3,527,673	20.21	9.96	17,455	318,766	336,221
PY9	Retail Buy Down	1,388,180	154,242	1,542,422			7,632	139,375	147,007
PY9	Giveaway	1,632	0	1,632			0	164	164
Total		**4,564,718**	**507,010**	**5,071,727**			**25,087**	**458,305**	**483,392**

5 Summary of Energy Impacts by Program

Figure 6 presents a summary of the PYTD reported gross energy savings by program for Program Year 9. The energy impacts in this report are presented at the meter level and do not reflect adjustments for transmission and distribution losses.

Figure 6: PYTD Reported Gross Energy Savings by Program

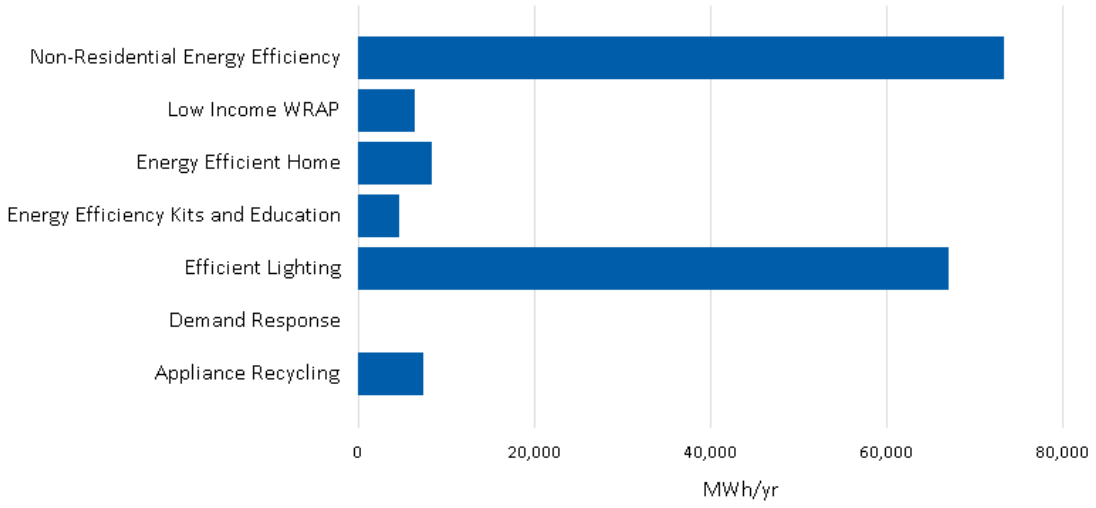
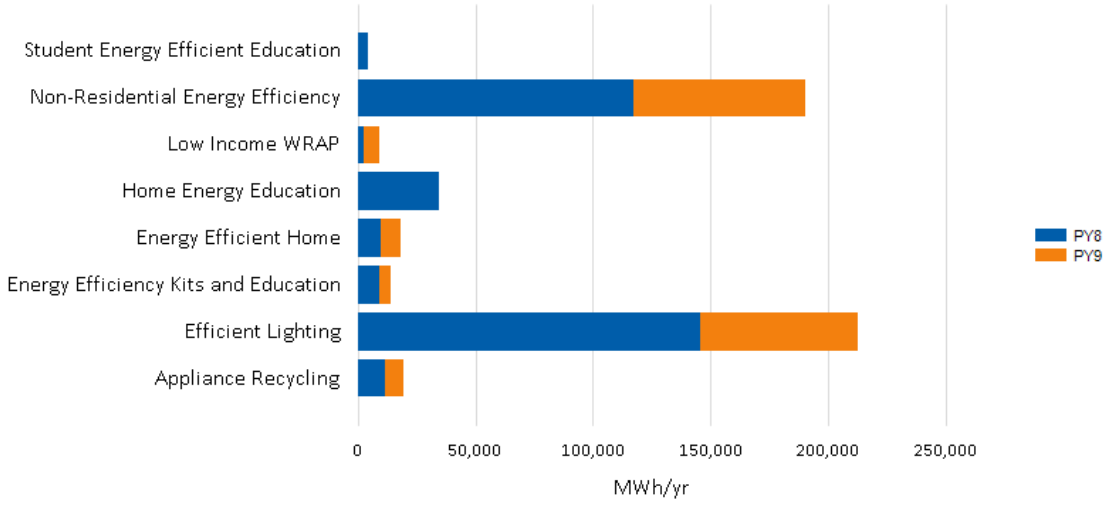


Figure 7 presents a summary of the PSA gross energy savings by program for Phase III of Act 129. PSA savings include verified gross savings from previous program years and the PYTD savings from the current program year.

Figure 7: PSA Energy Savings by Program for Phase III



A summary of energy impacts by program through the current reporting period is presented in Table 7.

Table 7: Energy Savings by Program (MWh/Year)

Program Name	PYTD MWh/yr	RTD MWh/yr	VTD MWh/yr	Unverified Savings from PY8 MWh/yr	PSA MWh/yr [1]
Appliance Recycling	7,449	19,484	11,844		19,293
Efficient Lighting	67,009	217,384	145,929		212,938
Energy Efficiency Kits and Education	4,779	15,199	9,219		13,999
Energy Efficient Home	8,356	18,977	9,943		18,299
Home Energy Education	0	40,467	34,326		34,326
Low Income WRAP	6,437	9,928	2,652	16	9,089
Non-Residential Energy Efficiency	73,390	220,891	117,285	27,417	190,675
Student Energy Efficient Education	0	5,118	4,539		4,539
Portfolio Total [2]	**167,420**	**547,449**	**335,739**	**27,432**	**503,159**
Adjustment for Home Energy Education Double-Counted Savings			(4,395)		(4,395)
Adjusted Portfolio Savings [2]			**331,344**		**498,764**

[1] 50,588 of PSA MWh/yr from Efficient Lighting are attributed to Small C&I.
[2] Portfolio total does not equal total of column due to rounding.

6 Summary of Demand Impacts by Program

PPL Electric Utilities' Phase III EE&C programs achieve peak demand reductions in two ways. The first is through coincident reductions from energy efficiency measures and the second is through dedicated demand response programs that exclusively target temporary demand reductions on peak days. Energy efficiency reductions coincident with system peak hours are reported and used in the calculation of benefits in the TRC Test, but do not contribute to Phase III peak demand reduction compliance goals. Phase III peak demand reduction targets are exclusive to demand response programs.

The two types of peak demand reduction savings are also treated differently for reporting purposes. Peak demand reductions from energy efficiency are generally additive across program years, meaning that the P3TD savings reflect the sum of the first-year savings in each program year. Conversely, demand response goals are based on average portfolio impacts across all events so cumulative DR performance is expressed as the *average* performance of each of the DR events called in Phase III to date. Because of these differences, demand impacts from energy efficiency and demand response are reported separately in the following sub-sections.

6.1 Energy Efficiency

Act 129 defines peak demand savings from energy efficiency as the average expected reduction in electric demand from 2:00 p.m. to 6:00 p.m. EDT on non-holiday weekdays from June to August. The peak demand impacts from energy efficiency in this report are presented at the meter level and do not reflect adjustments for transmission and distribution losses. Figure 8 presents a summary of the PYRTD reported gross peak demand savings by energy efficiency program for Program Year 9.

Figure 8: PYRTD Gross Demand Savings by Energy Efficiency Program

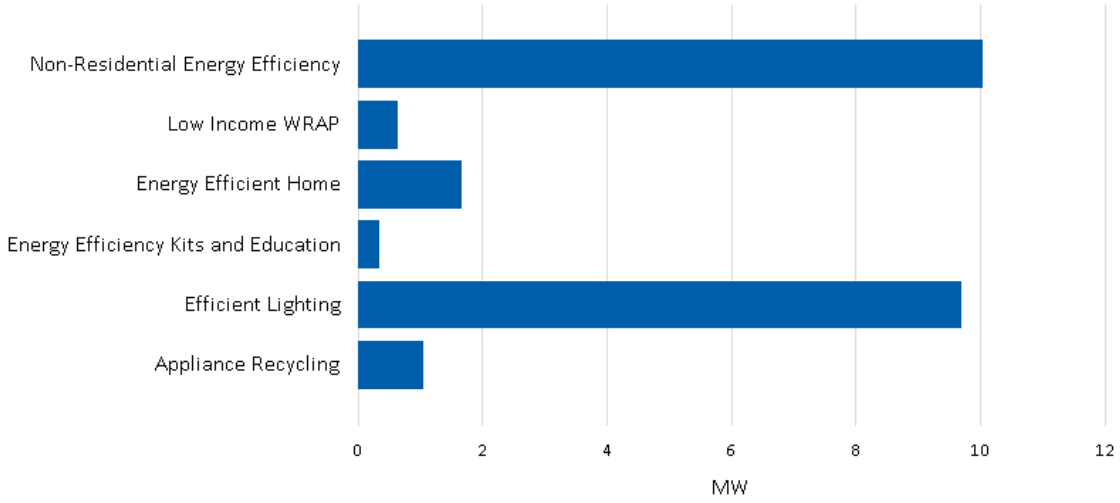
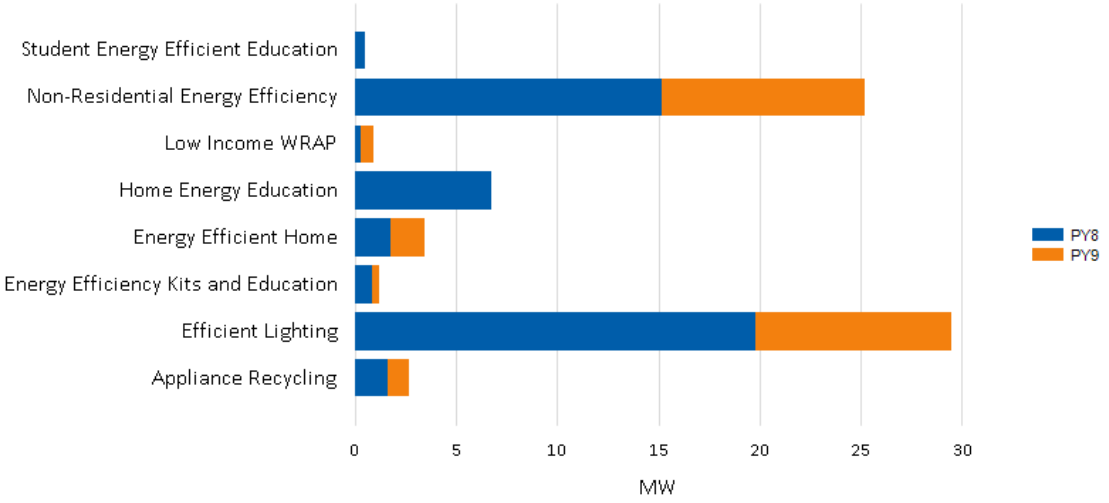


Figure 9 presents a summary of the PSA gross demand savings by energy efficiency program for Phase III of Act 129.

Figure 9: PSA Demand Savings by Energy Efficiency Program for Phase III



A summary of the peak demand impacts by energy efficiency program through the current reporting period are presented in Table 8.

Table 8: Peak Demand Savings by Energy Efficiency Program (MW/Year)

Program Name	PYTD MW/yr	RTD MW/yr	VTD MW/yr	Unverified Savings from PY8 MW/yr	PSA MW/yr [1]
Appliance Recycling	1.05	2.70	1.63		2.67
Efficient Lighting	9.69	31.83	19.82		29.51
Energy-Efficiency Kits and Education	0.35	1.10	0.88		1.23
Energy Efficient Home	1.67	3.62	1.78		3.46
Home Energy Education	0.00	54.39	6.75		6.75
Low-Income WRAP	0.64	0.98	0.29	0.00	0.93
Non-Residential Energy Efficiency	10.03	29.15	15.17	3.09	25.20
Student Energy Efficient Education	0.00	0.46	0.49		0.49
Portfolio Total [2]	**23.43**	**124.24**	**46.81**	**3.09**	**70.24**

[1] 10.79 of PSA MW from Efficient Lighting are attributed to Small C&I.
[2] Portfolio total does not equal total of column due to rounding.

6.2 DEMAND RESPONSE

Act 129 defines peak demand savings from demand response as the average reduction in electric demand during the hours when a demand response event is initiated. Phase III DR events are initiated according to the following guidelines:

1) Curtailment events shall be limited to the months of June through September.
2) Curtailment events shall be called for the first six days of each program year (starting in PY9) in which the peak hour of PJM's day-ahead forecast for the PJM RTO is greater than 96% of the PJM RTO summer peak demand forecast for the months of June through September.
3) Each curtailment event shall last four hours.
4) Each curtailment event shall be called such that it will occur during the day's forecasted peak hour(s) above 96% of PJM's RTO summer peak demand forecast.
5) Once six curtailment events have been called in a program year, the peak demand reduction program shall be suspended for that program year.

The peak demand impacts from demand response in this report are presented at the system level and reflect adjustments to account for transmission and distribution losses. PPL Electric Utilities uses the following line loss percentages/multipliers by sector.

- Residential = [8.75% or 1.0875]
- Small C&I = [8.75% or 1.0875]
- Large C&I = [4.2% or 1.0420]

Table 9 summarizes the PYVTD and VTD demand reductions for each of the demand response programs in the EE&C plan and for the demand response portfolio as a whole. VTD demand reductions are the average performance across all Phase III demand response events independent of how many events occurred in a given program year. The relative precision columns in Table 9 indicate the margin of error (at the 90% confidence interval) around the PYVTD and VTD demand reductions.

Table 9: Verified Gross Demand Response Impacts by Program

Program	PYVTD Gross MW	Relative Precision (90%) [1]	VTD Gross MW	Relative Precision (90%) [1]
Demand Response	126.68	3%	126.68	3%
Portfolio Total	126.68	**3%**	126.68	**3%**

[1] Precision accounts for the covariance of a participant facility's savings over hours of an event; however, it does not account for the covariance of a participant facility's savings across events.

7 Summary of Finances

Section 7 provides an overview of the expenditures associated with PPL Electric Utilities' portfolio and the recovery of those costs from ratepayers.

7.1 Program Financials

Program-specific and portfolio total finances for PY9 are shown in Table 10. The columns in Table 10 and Table 11 are adapted from the 'Direct Program Cost' categories in the Commission's EE&C Plan template[6] for Phase III. EDC Materials, Labor, and Administration includes costs associated with an EDC's own employees. ICSP Materials, Labor, and Administration includes both the program implementation contractor and the costs of any other outside vendors and EDCs employs to support program delivery.

Table 10: Program Year to Date Financials

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total [1]
Appliance Recycling Program	$197	$23	$875	-	$1,094
Demand Response Program	$980	$39	$267	-	$1,285
Efficient Lighting Program	$3,947	$28	$560	-	$4,535
Energy Efficiency Kits & Education Program [2]	-	$24	$810	-	$834
Energy Efficient Home Program	$1,165	$30	$1,437	-	$2,633
Home Energy Education Program	-	$10	$1,023	-	$1,033
Low-Income WRAP Program [2]	-	$97	$3,465	-	$3,562
Non-Residential Energy Efficiency	$3,225	$90	$2,584		$5,900
Student Energy Efficiency Education Program	-	$23	$667	-	$690
Common Portfolio Costs [3]	-	$1,972	$431	$2,617	$5,020
Portfolio Total [4]	**$9,514**	**$2,336**	**$12,118**	**$2,617**	**$26,585**
SWE Costs [5]	-	-	-	-	**$200**
Total [1]	**$9,514**	**$2,336**	**$12,118**	**$2,617**	**$26,785**

[1] Total may not equal sum of column due to rounding.
[2] Costs associated with low income program measures provided to customers at no cost are categorized as administrative costs.
[3] Common Portfolio Costs are costs applicable to more than one customer class, to more than one program, or those that provide portfolio-wide benefits. These include PPL Electric labor and materials, costs related to the EEMIS tracking system, EE&C plan development, etc.
[4] Portfolio Total and Total may not equal total of column due to rounding.
[5] Statewide Evaluation costs are outside of the 2% spending cap.

[6] Pennsylvania Public Utility Commission Phase III Energy Efficiency and Conservation Plan Template (Docket No. M-2014-2424864) dated July 21, 2015. (http://www.puc.pa.gov/pcdocs/1372426.doc)

Program-specific and portfolio total finances since the inception of Phase III are shown in Table 11.

Table 11: Phase III to Date Financials

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total [5]
Appliance Recycling Program	$538	$60	$2,441	-	$3,039
Demand Response Program	$980	$187	$765	-	$1,932
Efficient Lighting Program	$15,460	$122	$2,115	-	$17,697
Energy Efficiency Kits & Education Program [1]	-	$86	$2,641	-	$2,728
Energy Efficient Home Program	$2,899	$104	$4,567	-	$7,570
Home Energy Education Program	-	$49	$1,829	-	$1,878
Low-Income WRAP Program [1]	-	$384	$7,190	-	$7,574
Non-Residential Energy Efficiency	$12,096	$358	$8,076		$20,530
Student Energy Efficiency Education Program	-	$118	$1,477	-	$1,595
Common Portfolio Costs [2]	-	$4,337	$2,878	$4,727	$11,942
Portfolio Total [3] [5]	**$31,972**	**$5,804**	**$33,981**	**$4,727**	**$76,484**
SWE Costs [4]	-	-	-	-	**$900**
Total [5]	**$31,972**	**$5,804**	**$33,981**	**$4,727**	**$77,384**

[1] Costs associated with low income program measures provided to customers at no cost are categorized as administrative costs.
[2] Common Portfolio Costs are costs applicable to more than one customer class, to more than one program, or those that provide portfolio-wide benefits. These include PPL Electric labor and materials, costs related to the EEMIS tracking system, EE&C plan development, etc.
[3] Portfolio Total may not equal total of column due to rounding.
[4] Statewide Evaluation costs are outside of the 2% spending cap.
[5] Total may not equal sum of column due to rounding.

Cost-effectiveness testing for Act 129 EE&C programs is performed using the TRC Test. Benefit cost modeling is conducted annually using verified gross and verified net savings once the results of the independent impact evaluation are completed. TRC test results for PY9 will be presented in the final annual report to the PA PUC on November 15, 2018 along with a more granular breakdown of portfolio costs.

7.2 Cost Recovery

Act 129 allows Pennsylvania EDCs to recover EE&C plan costs through a cost-recovery mechanism. PPL Electric Utilities' cost-recovery charges organized separately by customer sectors to ensure that the electric rate classes that finance the programs are the rate classes that receive the direct energy and conservation benefits. Cost-recovery is necessarily tied to the way customers are metered and charges for electric service. Readers should be

mindful of the differences between Table 12 and Section 2.4. For example, the low-income customer segment is a subset of PPL Electric Utilities' residential tariff(s) and therefore not listed in Table 12.

Table 12: EE&C Plan Expenditures by Cost-Recovery Category ($1,000)

Cost Recovery Customer Sector	Rate Schedules Included	PYTD Spending	P3TD Spending
Residential & Low Income	Residential (primarily RS)	$15,029	$42,626
Small Commercial and Industrial (Small C&I)	Small C&I (primarily GS1 & GS3)	$2,427	$8,887
Large Commercial and Industrial (Large C&I)	Large C&I (primarily LP4 & LP5)	$4,181	$10,692
GNE	Residential, Small C&I, and Large C&I	$1,991	$6,421
No Sector [1] [2]	N/A	$3,157	$8,758
Portfolio Total [3]	**-**	**$26,785**	**$77,384**

[1] Costs not collected at the sector level, including both direct program costs and common portfolio costs. These costs will be allocated to the sectors at the conclusion of Phase III.
[2] Includes SWE costs.
[3] Portfolio total may not equal sum of rows due to rounding.